IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:

Applicants :	Constantine Tsikos and C. Harry Knowles
Application Serial No.:	10/068,803
Filing Date :	February 6, 2002
Title :	BIOPTICAL PRODUCT AND PRODUCE IDENTIFICATION SYSTEMS EMPLOYING PLANAR LASER ILLUMINATION AND IMAGING (PLIIM) BASED SUBSYSTEMS
Examiner :	not yet assigned
Group Art Unit :	2876
Attorney Docket No. :	108-127USAND0

Honorable Commissioner
of Patents and Trademarks
Washington, D.C. 20231

THIRD PRELIMINARY AMENDMENT

Sir:

Prior to examination of the above-referenced Patent Application, please amend the same as follows:

AMENDMENT OF THE SPECIFICATION:

On Page 121, please amend the first and fourth paragraphs as follows:

[Fig. 33C is] Figs. 33C1 and 33C2 set forth a system block diagram illustrating the system architecture of the bioptical PLIIM-based product dimensioning, analysis and identification system of the first illustrative embodiment shown in Figs. 33A and 33B;

[Fig. 34C is] Figs. 34C1 and 34C2 set forth a system block diagram illustrating the system architecture of the bioptical PLIIM-based product dimensioning, analysis and identification system of the second illustrative embodiment shown in Figs. 34A and 34B;

On Page 158, amend the third paragraph as follows:

In order that PLLIM-based subsystem 25 can be readily interfaced to and an integrated (e.g. embedded) within various types of computer-based systems, as shown in Figs. 9 through

[34C] 34C2, subsystem 25 also comprises an I/0 subsystem 500 operably connected to camera control computer 22 and image processing computer 21, and a network controller 501 for enabling high-speed data communication with others computers in a local or wide area network using packet-based networking protocols (e.g. Ethernet, AppleTalk, etc.) well known in the art.

On Page 243, amend the fifth paragraph as follows:

In view of the fact that linear CCD image detectors with 200 micron tall image detection elements are generally commercially available in lengths of only one or two thousand image detection elements (i.e. pixels), the PLIB/FOV alignment method described above would be best applicable to PLIIM-based hand-held imaging applications as illustrated, for example, in Figs. 1I25A2 through 1I25N2. In view of the fact that most industrial-type imaging systems require linear image sensors having six to eight thousand image detection elements, the PLIB/FOV alignment method illustrated in Fig. 1B3 would be best applicable to PLIIM-based conveyor-mounted/industrial imaging systems as illustrated, for example, in Figs. 9 through 32A. Depending on the optical path lengths required in the PLIIM-based POS imaging systems shown in Figs. 33A through [34C] 34C2, either of these PLIB/FOV alignment methods may be used with excellent results.

On Page 275, amend the third paragraph as follows:

In order that PLLIM-based subsystem 25' can be readily interfaced to and an integrated (e.g. embedded) within various types of computer-based systems, as shown in Figs. 9 through [34C] 34C2, subsystem 25' also comprises an I/0 subsystem 500 operably connected to camera control computer 22 and image processing computer 21, and a network controller 501 for enabling high-speed data communication with others computers in a local or wide area network using packet-based networking protocols (e.g. Ethernet, AppleTalk, etc.) well known in the art.

On Page 297, amend the third paragraph as follows:

In order that PLLIM-based subsystem 25'' can be readily interfaced to and integrated (e.g. embedded) within various types of computer-based systems, as shown in Figs. 9 through

[34C] 34C2, subsystem 25'' further comprises an I/0 subsystem 500 operably connected to camera control computer 22 and image processing computer 21, and a network controller 501 for enabling high-speed data communication with other computers in a local or wide area network using packet-based networking protocols (e.g. Ethernet, AppleTalk, etc.) well know in the art.

On Page 326, amend paragraphs 2-4 as follows:

As shown in Figs. 33A through [33C] 33C2, a pair of PLIIM-based package identification (PID) systems 25' of Figs. 3E4 through 3E8 are modified and arranged within a compact POS housing 581 having bottom and side light transmission apertures 582 and 583 (beneath bottom and side imaging windows 584 and 585, respectively), to produce a bioptical PLIIM-based product identification, dimensioning and analysis (PIDA) system 580 according to a first illustrative embodiment of the present invention. As shown in [Fig. 33C] Figs. 33C1 and 33C2, the bioptical PIDA system 580 comprises: a bottom PLIIM-based unit 586A mounted within the bottom portion of the housing 581; a side PLIIM-based unit 586B mounted within the side portion of the housing 581; an electronic product weigh scale 587, mounted beneath the bottom PLIIM-based unit 587A, in a conventional manner; and a local data communication network 588, mounted within the housing, and establishing a high-speed data communication link between the bottom and side units 586A and 586B, and the electronic weigh scale 587, and a host computer system (e.g. cash register) 589.

As shown in [Fig. 33C] Figs. 33C1 and 33C2, the bottom unit 586A comprises: a PLIIM-based PID subsystem 25' (without LDIP subsystem 122), installed within the bottom portion of the housing 587, for projecting a coplanar PLIB and 1-D FOV through the bottom light transmission aperture 582, on the side closest to the product entry side of the system indicated by the "arrow" (⇐) indicator shown in the figure drawing; a I/O subsystem 127 providing data, address and control buses, and establishing data ports for data input to and data output from the PLIIM-based PID subsystem 25'; and a network controller 132, operably connected to the I/O subsystem 127 and the communication medium of the local data communication network 588.

As shown in [Fig. 33C] Figs. 33C1 and 33C2, the side unit 586B comprises: a PLIIM-based PID subsystem 25' (with LDIP subsystem 122), installed within the side portion of the housing 581, for projecting (i) a coplanar PLIB and 1-D FOV through the side light transmission

aperture 583, also on the side closest to the product entry side of the system indicated by the "arrow" (⇐) indicator shown in the figure drawing, and also (ii) a pair of AM laser beams, angularly spaced from each other, through the side light transmission aperture 583, also on the side closest to the product entry side of the system indicated by the "arrow" (⇐) indicator shown in the figure drawing, but closer to the arrow indicator than the coplanar PLIB and 1-D FOV projected by the subsystem, thus locating them slightly downstream from the AM laser beams used for product dimensioning and detection; a I/O subsystem 127 for establishing data ports for data input to and data output from the PLIIM-based PIB subsystem 25'; a network controller 132, operably connected to the I/O subsystem 127 and the communication medium of the local data communication network 588; and a system control computer 590, operably connected to the I/O subsystem 127, for (i) receiving package identification data elements transmitted over the local data communication network by either PLIIM-based PID subsystem 25', (ii) package dimension data elements transmitted over the local data communication network by the LDIP subsystem 122, and (iii) package weight data elements transmitted over the local data communication network by the electronic weigh scale 587. As shown, LDIP subsystem 122 includes an integrated package/object velocity measurement subsystem

On Page 329, amend paragraphs 1-3 as follows:

In alternative embodiments of the bioptical system described above, both the side and bottom units can be provided with an LDIP subsystem 122 for product/produce dimensioning operations. Also, it may be desirable to use a simpler set of image forming optics than that provided within IFD subsystem 3''. Also, it may desirable to use PLIIM-based subsystems which have FOVs that are automatically swept across a large 3-D scanning volume definable between the bottom and side imaging windows 584 and 585. The advantage of this type of system design is that the product or item of produce can be presented to the bioptical system without the need to move the product or produce item past the bioptical system along a predetermined scanning/imaging direction, as required in the illustrative system of Figs. 33A through [33C] <u>33C2</u>. With this modification in mind, reference is now made to Figs. 34A through [34C] <u>34C2</u> in which an alternative bioptical vision-based product/produce identification

system 600 is disclosed employing the PLIIM-based camera system disclosed in Figs. 6D1 through 6E3.

Bioptical PLIIM-Based Product Identification, Dimensioning and Analysis System Of The Second Illustrative Embodiment Of The Present Invention

As shown in Figs. 34A through [34C] 34C2, a pair of PLIIM-based package identification (PID) systems 25'' of Figs. 6D1 through 6E3 are modified and arranged within a compact POS housing 601 having bottom and side light transmission windows 602 and 603 (beneath bottom and side imaging windows 604 and 605, respectively), to produce a bioptical PLIIM-based product identification, dimensioning and analysis (PIDA) system 600 according to a second illustrative embodiment of the present invention. As shown in [Fig. 34C] Figs. 34C1 and 34C2, the bioptical PIDA system 600 comprises: a bottom PLIIM-based unit 606A mounted within the bottom portion of the housing 601; a side PLIIM-based unit 606B mounted within the side portion of the housing 601; an electronic product weigh scale 589, mounted beneath the bottom PLIIM-based unit 606A, in a conventional manner; and a local data communication network 588, mounted within the housing, and establishing a high-speed data communication link between the bottom and side units 606A and 606B, and the electronic weigh scale 589.

As shown in [Fig. 34C] Figs. 34C1 and 34C2, the bottom unit 606A comprises: a PLIIM-based PIB subsystem 25'' (without LDIP subsystem 122), installed within the bottom portion of the housing 601, for projecting an automatically swept PLIB and a stationary 3-D FOV through the bottom light transmission window 602; a I/O subsystem 127 providing data, address and control buses, and establishing data ports for data input to and data output from the PLIIM-based PID subsystem 25''; and a network controller 132, operably connected to the I/O subsystem 127 and the communication medium of the local data communication network 588.

On Page 330, amend the first paragraph as follows:

As shown in [Fig. 34C] Figs. 34C1 and 34C2, the side unit 606A comprises: a PLIIM-based PID subsystem 25'' (with modified LDIP subsystem 122'), installed within the side portion of the housing 601, for projecting (i) an automatically swept PLIB and a stationary 3-D FOV through the bottom light transmission window 605, and also (ii) a pair of automatically

swept AM laser beams 607A, 607B, angularly spaced from each other, through the side light transmission window 604; a I/O subsystem 127 for establishing data ports for data input to and data output from the PLIIM-based PID subsystem 25''; a network controller 132, operably connected to the I/O subsystem 127 and the communication medium of the local data communication network 588; and a system control data management computer 609, operably connected to the I/O subsystem 127, for (i) receiving package identification data elements transmitted over the local data communication network by either PLIIM-based PID subsystem 25'', (ii) package dimension data elements transmitted over the local data communication network by the LDIP subsystem 122, and (iii) package weight data elements transmitted over the local data communication network by the electronic weigh scale 587. As shown, modified LDIP subsystem 122' is similar in nearly all respects to LDIP subsystem 122, except that its beam folding mirror 163 is automatically oscillated during dimensioning in order to swept the pair of AM laser beams across the entire 3-D FOV of the side unit of the system when the product or produce item is positioned at rest upon the bottom imaging window 604. In the illustrative embodiment, the PLIIM-based camera subsystem 25'' is programmed to automatically capture images of its 3-D FOV to determine whether or not there is a stationary object positioned on the bottom imaging window 604 for dimensioning. When such an object is detected by this PLIIM-based subsystem, it either directly or indirectly automatically activates LDIP subsystem 122' to commence laser scanning operations within the 3-D FOV of the side unit and dimension the product or item of produce.

REQUIREMENT UNDER 37 C.F.R. 1.121

As required under 37 C.F.R.1.121, and pursuant to the present Amendment, a clean version of the amended paragraphs is as follows:

On Page 121, the first and fourth paragraphs should read as follows:

Figs. 33C1 and 33C2 set forth a system block diagram illustrating the system architecture of the bioptical PLIIM-based product dimensioning, analysis and identification system of the first illustrative embodiment shown in Figs. 33A and 33B;

Figs. 34C1 and 34C2 set forth a system block diagram illustrating the system architecture of the bioptical PLIIM-based product dimensioning, analysis and identification system of the second illustrative embodiment shown in Figs. 34A and 34B;

On Page 158, the third paragraph should read as follows:

In order that PLLIM-based subsystem 25 can be readily interfaced to and an integrated (e.g. embedded) within various types of computer-based systems, as shown in Figs. 9 through [34C] 34C2, subsystem 25 also comprises an I/0 subsystem 500 operably connected to camera control computer 22 and image processing computer 21, and a network controller 501 for enabling high-speed data communication with others computers in a local or wide area network using packet-based networking protocols (e.g. Ethernet, AppleTalk, etc.) well known in the art.

On Page 243, the fifth paragraph should read as follows:

In view of the fact that linear CCD image detectors with 200 micron tall image detection elements are generally commercially available in lengths of only one or two thousand image detection elements (i.e. pixels), the PLIB/FOV alignment method described above would be best applicable to PLIIM-based hand-held imaging applications as illustrated, for example, in Figs. 1I25A2 through 1I25N2. In view of the fact that most industrial-type imaging systems require linear image sensors having six to eight thousand image detection elements, the PLIB/FOV alignment method illustrated in Fig. 1B3 would be best applicable to PLIIM-based conveyor-

mounted/industrial imaging systems as illustrated, for example, in Figs. 9 through 32A. Depending on the optical path lengths required in the PLIIM-based POS imaging systems shown in Figs. 33A through 34C2, either of these PLIB/FOV alignment methods may be used with excellent results.

On Page 275, the third paragraph should read as follows:

In order that PLLIM-based subsystem 25' can be readily interfaced to and an integrated (e.g. embedded) within various types of computer-based systems, as shown in Figs. 9 through 34C2, subsystem 25' also comprises an I/0 subsystem 500 operably connected to camera control computer 22 and image processing computer 21, and a network controller 501 for enabling high-speed data communication with others computers in a local or wide area network using packet-based networking protocols (e.g. Ethernet, AppleTalk, etc.) well known in the art.

On Page 297, the third paragraph should read as follows:

In order that PLLIM-based subsystem 25'' can be readily interfaced to and integrated (e.g. embedded) within various types of computer-based systems, as shown in Figs. 9 through 34C2, subsystem 25'' further comprises an I/0 subsystem 500 operably connected to camera control computer 22 and image processing computer 21, and a network controller 501 for enabling high-speed data communication with other computers in a local or wide area network using packet-based networking protocols (e.g. Ethernet, AppleTalk, etc.) well know in the art.

On Page 326, paragraphs 2-4 should read as follows:

As shown in Figs. 33A through 33C2, a pair of PLIIM-based package identification (PID) systems 25' of Figs. 3E4 through 3E8 are modified and arranged within a compact POS housing 581 having bottom and side light transmission apertures 582 and 583 (beneath bottom and side imaging windows 584 and 585, respectively), to produce a bioptical PLIIM-based product identification, dimensioning and analysis (PIDA) system 580 according to a first illustrative embodiment of the present invention. As shown in Figs. 33C1 and 33C2, the bioptical PIDA system 580 comprises: a bottom PLIIM-based unit 586A mounted within the

bottom portion of the housing 581; a side PLIIM-based unit 586B mounted within the side portion of the housing 581; an electronic product weigh scale 587, mounted beneath the bottom PLIIM-based unit 587A, in a conventional manner; and a local data communication network 588, mounted within the housing, and establishing a high-speed data communication link between the bottom and side units 586A and 586B, and the electronic weigh scale 587, and a host computer system (e.g. cash register) 589.

As shown in Figs. 33C1 and 33C2, the bottom unit 586A comprises: a PLIIM-based PID subsystem 25' (without LDIP subsystem 122), installed within the bottom portion of the housing 587, for projecting a coplanar PLIB and 1-D FOV through the bottom light transmission aperture 582, on the side closest to the product entry side of the system indicated by the "arrow" (⇐) indicator shown in the figure drawing; a I/O subsystem 127 providing data, address and control buses, and establishing data ports for data input to and data output from the PLIIM-based PID subsystem 25'; and a network controller 132, operably connected to the I/O subsystem 127 and the communication medium of the local data communication network 588.

As shown in Figs. 33C1 and 33C2, the side unit 586B comprises: a PLIIM-based PID subsystem 25' (with LDIP subsystem 122), installed within the side portion of the housing 581, for projecting (i) a coplanar PLIB and 1-D FOV through the side light transmission aperture 583, also on the side closest to the product entry side of the system indicated by the "arrow" (⇐) indicator shown in the figure drawing, and also (ii) a pair of AM laser beams, angularly spaced from each other, through the side light transmission aperture 583, also on the side closest to the product entry side of the system indicated by the "arrow" (⇐) indicator shown in the figure drawing, but closer to the arrow indicator than the coplanar PLIB and 1-D FOV projected by the subsystem, thus locating them slightly downstream from the AM laser beams used for product dimensioning and detection; a I/O subsystem 127 for establishing data ports for data input to and data output from the PLIIM-based PIB subsystem 25'; a network controller 132, operably connected to the I/O subsystem 127 and the communication medium of the local data communication network 588; and a system control computer 590, operably connected to the I/O subsystem 127, for (i) receiving package identification data elements transmitted over the local data communication network by either PLIIM-based PID subsystem 25', (ii) package dimension data elements transmitted over the local data communication network by the LDIP subsystem 122, and (iii) package weight data elements transmitted over the local data communication

network by the electronic weigh scale 587. As shown, LDIP subsystem 122 includes an integrated package/object velocity measurement subsystem

On Page 329, paragraphs 1-3 should read as follows:

In alternative embodiments of the bioptical system described above, both the side and bottom units can be provided with an LDIP subsystem 122 for product/produce dimensioning operations. Also, it may be desirable to use a simpler set of image forming optics than that provided within IFD subsystem 3''. Also, it may desirable to use PLIIM-based subsystems which have FOVs that are automatically swept across a large 3-D scanning volume definable between the bottom and side imaging windows 584 and 585. The advantage of this type of system design is that the product or item of produce can be presented to the bioptical system without the need to move the product or produce item past the bioptical system along a predetermined scanning/imaging direction, as required in the illustrative system of Figs. 33A through 33C2. With this modification in mind, reference is now made to Figs. 34A through 34C2 in which an alternative bioptical vision-based product/produce identification system 600 is disclosed employing the PLIIM-based camera system disclosed in Figs. 6D1 through 6E3.

<u>Bioptical PLIIM-Based Product Identification, Dimensioning and Analysis System Of The Second Illustrative Embodiment Of The Present Invention</u>

As shown in Figs. 34A through 34C2, a pair of PLIIM-based package identification (PID) systems 25'' of Figs. 6D1 through 6E3 are modified and arranged within a compact POS housing 601 having bottom and side light transmission windows 602 and 603 (beneath bottom and side imaging windows 604 and 605, respectively), to produce a bioptical PLIIM-based product identification, dimensioning and analysis (PIDA) system 600 according to a second illustrative embodiment of the present invention. As shown in Figs. 34C1 and 34C2, the bioptical PIDA system 600 comprises: a bottom PLIIM-based unit 606A mounted within the bottom portion of the housing 601; a side PLIIM-based unit 606B mounted within the side portion of the housing 601; an electronic product weigh scale 589, mounted beneath the bottom PLIIM-based unit 606A, in a conventional manner; and a local data communication network

588, mounted within the housing, and establishing a high-speed data communication link between the bottom and side units 606A and 606B, and the electronic weigh scale 589.

As shown in Figs. 34C1 and 34C2, the bottom unit 606A comprises: a PLIIM-based PIB subsystem 25'' (without LDIP subsystem 122), installed within the bottom portion of the housing 601, for projecting an automatically swept PLIB and a stationary 3-D FOV through the bottom light transmission window 602; a I/O subsystem 127 providing data, address and control buses, and establishing data ports for data input to and data output from the PLIIM-based PID subsystem 25''; and a network controller 132, operably connected to the I/O subsystem 127 and the communication medium of the local data communication network 588.

On Page 330, the first paragraph should read as follows:

As shown in Figs. 34C1 and 34C2, the side unit 606A comprises: a PLIIM-based PID subsystem 25'' (with modified LDIP subsystem 122'), installed within the side portion of the housing 601, for projecting (i) an automatically swept PLIB and a stationary 3-D FOV through the bottom light transmission window 605, and also (ii) a pair of automatically swept AM laser beams 607A, 607B, angularly spaced from each other, through the side light transmission window 604; a I/O subsystem 127 for establishing data ports for data input to and data output from the PLIIM-based PID subsystem 25''; a network controller 132, operably connected to the I/O subsystem 127 and the communication medium of the local data communication network 588; and a system control data management computer 609, operably connected to the I/O subsystem 127, for (i) receiving package identification data elements transmitted over the local data communication network by either PLIIM-based PID subsystem 25'', (ii) package dimension data elements transmitted over the local data communication network by the LDIP subsystem 122, and (iii) package weight data elements transmitted over the local data communication network by the electronic weigh scale 587. As shown, modified LDIP subsystem 122' is similar in nearly all respects to LDIP subsystem 122, except that its beam folding mirror 163 is automatically oscillated during dimensioning in order to swept the pair of AM laser beams across the entire 3-D FOV of the side unit of the system when the product or produce item is positioned at rest upon the bottom imaging window 604. In the illustrative embodiment, the PLIIM-based camera subsystem 25'' is programmed to automatically capture images of its 3-D FOV to determine whether or not there is a stationary object positioned on the

bottom imaging window 604 for dimensioning. When such an object is detected by this PLIIM-based subsystem, it either directly or indirectly automatically activates LDIP subsystem 122' to commence laser scanning operations within the 3-D FOV of the side unit and dimension the product or item of produce.

REMARKS

Applicants submit the present Amendment in order to ensure correspondence between the Specification and Formal Drawings filed herewith and in response to the Notice to File Missing Parts mailed July 1, 2002.

Respectfully submitted,

Dated: October 1, 2002

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Dated: October 1, 2002